

# Ukko opaštai lapšie äijän - Serious games as tools for teaching Viena Karelian to Finns?

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**Abstract**—The Karelian language is the closest linguistic relative to Finnish. It is spoken in Finland and Russia, in the Republic of Karelia. Karelian is classified as a minority and endangered language. Karelian is divided into two main dialects; Karelian Proper and Olonets Karelian. Karelian Proper is divided into North Karelia (Viena), and South Karelian. Viena Karelian is the closest dialect to Finnish language and it is needed for the communication between Finns and Viena Karelians. In this paper, we propose gamification approach and serious games to be taken as tools for revitalizing Karelian language and culture. This paper presents game prototypes called Šanakoški and Hirsipuu, which have been developed for teaching and learning Viena Karelian. We conducted user experience evaluations with 16 participants whose age varied from 10 to 84 years and 63 % of them had prior skills of Viena Karelian. The Šanakoški prototype was regarded as Easy to use, Support learning, Useful and Entertaining. Hirsipuu prototype was perceived as Inspiring, Easy to use, Entertaining, Useful and Fun.

## I. INTRODUCTION

Gamification approach can be used to develop games from non-gaming contexts, such as formal studies, books, social interactions, by applying game design elements, and thus increase the motivation and engagement of players [1],[2]. Educational games with gamification can provide a better learning environment and enhance the fun experiences and knowledge acquisition rather than by using only face-to-face learning in the traditional classroom setting [3],[4],[5],[6]. The motivation and engagement of players are important aspects to increase the effectiveness in language and culture learning [7], especially with younger people.

Karelian is minority and endangered language [8]. It is divided into two main dialects, which are Karelian Proper and Olonets Karelian (Livvi Karelian). Moreover, Karelian Proper is divided into North Karelia (Viena), and South Karelian [9],[10],[11],[12]. However, general public can easily misunderstand Karelian as the Southeastern dialects of Finnish, which is sometimes referred to as Karelian dialects (karjalaismurteet) in Finland [12]. Therefore, it is important to increase awareness of Karelian language.

There exists different estimations of Karelian speakers in Finland. According to one estimation, there are about 5,000 people who speak Karelian language daily in Finland and approximately 20,000 people who have ancestral lineage in Karelian and they can understand Karelian language to some extent [13]. According to Sarhimaa, there are about 11,000 Karelian speakers in Finland who can speak Karelian well or

very well [13]. The number of speakers will decrease dramatically if new generations do not have possibilities to learn Karelian from parents and grandparents or by some other reliable and interesting ways. Therefore, it is critical to develop new effective methods for teaching the various forms of Karelian (e.g. Viena Karelian). Because Karelian language is used in both countries in Finland and Russia it is also needed to provide location-independent solutions for self-studying, for instance, easily available and accessible web and mobile games. One way to enhance revitalize language is to develop multiplayer solutions for Finns and Karelians where they could practice language skills in social interaction through the serious game.

According to our knowledge, there are not much existing mobile games to learn Viena Karelian and culture. A beta version of the Kielimestari [14] application has been published in July 2019, and it is available in Google Play. The aim of this application is to increase awareness of Finland's minority languages such as Swedish, Northern Sami and Karelian. One example of the web game for learning Viena Karelian is the Uuši vuoši [15] game. This game is targeted for children and new learners, and with native voice examples it provides a good possibility to hear and learn how letters š and č are pronounced in Viena Karelian. However, much more mobile and web games are needed for different age groups with various Karelian language skills (e.g. new learners, advanced learners, different types of natives: Finns, Karelians).

Therefore, we have developed different game concepts and prototypes, and conducted user experience (UX) evaluations. The aim of all these examples is to teach vocabulary and culture information to new learners. Our early prototypes were perceived, for instance, as motivated, entertaining and useful, even though there were some lacks in usability and visual design aspects [16],[17].

In this paper, we propose gamification approach and serious games to be taken as tools for revitalizing Karelian language and culture. We first present the development of a mobile game prototype called Šanakoški and show how the online dictionary of Karelian language was tailored for this game. Then we describe the development of the Hirsipuu game prototype. Then we present the findings of UX evaluation, where these game prototypes were tested along with the other three examples (vocabulary creation, Learn Viena Karelian, Karelian village). Finally, we briefly discuss and then conclude the paper.

## II. GAMIFICATION AND KARELIAN GAMES

The aim of gamification is to increase the motivation and engagement of users [18],[19]. Books, face-to-face learning, and social interactions to learn language and culture in educational settings are examples of non-gaming context. It is important to notice that gamification can create learning environments to be more attractive. Game design elements for gamification are simpler than pure-entertainment games because it focuses on the knowledge acquisition and learning process [3],[4], where gamification elements can be showed as levels, progress status, and score [1]. Gamification can be applied for educational purposes, for instance by focusing on the learning environment rather than entertainment aspects [3].

In gamification approach, educational games can be seen to be better than traditional teaching methods such as face-to-face learning in the classroom setting [3],[5],[6]. The main purposes of educational games are to increase the effectiveness of the learning process and knowledge acquisition [4]. Players can learn while playing the games with interesting and attractive gameplays for educational purposes. Educational games concentrate on engagement, simpler features, gameplays, and learning activities [1],[18].

During our game development, it was difficult to find serious games relating to Viena Karelian dialect and culture. The one we found is the *Uuši vuoši* [15] game, which we perceived as a cute, simple and quite short game for learning Viena Karelian. In our opinion, the best feature in this game is the native voice, which guides the player through the game. The player will learn how Viena Karelian sounds like and how to pronounce certain letters (e.g. š or č) and words. This game would be useful to use with children and new learnings as a part of Viena Karelian course, lesson or some club (e.g. fairy tale or spectacle session).

On July 2019, a new game-based mobile application called *Kielimestari* [14] was published and it is available in Google Play. The aim of this application is to increase awareness of Finland's minority languages such as Swedish, Northern Sami and Karelian. This application is good for all who are interested in Finnish history and wants to learn about minority languages. The game consists of different minigames with language examples. This type of game can attract also foreign people to learn more about Finland.

There are also some games developed for teaching about the Finnish national epic the *Kalevala*. One game is *Heroes of Kalevala*, which can be played on mobile or PC device [20]. Other *Kalevala* related game is traditional board game called *Väinämöisen matka* [21]. 'Sammon salat' game is targeted for 6<sup>th</sup> to 9<sup>th</sup> grade pupils [22]. In this game, the aim is to learn characters of *Kalevala* and their stories and the main poems. In addition, the game teaches about the author of the *Kalevala*, Elias Lönnroth and his life and influences on Finnish culture. This game includes also minigames and it is free and available for Apple and Android operation systems.

However, these type of *Kalevala* related games only in Finnish are not enough if the person wants to learn Viena Karelian and its culture. Therefore, the game prototype called *Learn Viena Karelian* was developed. The aim of this

prototype is to revitalize Viena Karelian dialect and culture [17] by proving different cultural information (e.g. history, event, mittens, etc.), when a player has reaches levels. This game is targeted for beginners and it starts with simple word and sentence examples and the level of difficulty increases the more the player complete the levels. This type of game is easy to approach. Unfortunately, currently this game prototype is implemented only in Finnish and English. It should be translated also in Russian and Karelian, and thus get more players from the Republic of the Karelia. In addition to these Viena Karelian game solutions, there exists a relatively old online game called *Riputandupučas* [23] which is hangman type game for learning Olonets Karelian (Livvi-Karelian). The database in this game includes 510 words in Livvi Karelian, which differs quite much from Viena Karelian.

All these examples indicate that there is a common interest and need to teach and learn Karelian related issues to Finns. However, this is not enough. There should be put more recourses and emphasis on teaching Karelian language to both Finnish and Karelians in both countries in Finland and Russia with new effective ways. Gamification and serious games could be one way to revitalize Karelian language. Especially, young generations should be involved in game development processes in order to create games that are interesting and easy to approach also for young people and new learners. Moreover, games should be developed in multidisciplinary teams including, for instance, teachers, linguistics, historians and game developers in order to find out the best game solutions for teaching Karelian language and culture.

## III. RESEARCH PROBLEM AND METHODS

The main research problem is to investigate what kind of serious games could be developed for learning and teaching Viena Karelian. In this project, our main targeted user groups were Finns who want to learn and practice Viena Karelian. Because Viena Karelian is very close to Finnish, and especially to a dialect spoken in a region of Northern Ostrobothnia and City of Oulu, it is challenging to develop games which are not too easy, nor too difficult for Finns. For instance, a sentence "Ukko opašttau lapšie äijän" is quite easy to understand, translate or learn based on Finnish, but mistakes can be easily made, because "ukko" means grandfather in Viena Karelian and an old man in Finnish. Moreover, ukko may not be so polite expression for the old man. Also, "äijä" in Finnish, is a kind of masculine man (e.g. tough guy) and it can have even a negative tone, but in Viena Karelian it means "much" or "several". Instead "Äijäpäivä" means Easter in Viena Karelian, but in Finnish it is "pääsiäinen". "Opašttau lapšie" is easy to read and understand but writing it correctly in a right form is more difficult to Finns. In Finnish this would be written "opettaa lapsia" (teaches children). These examples show that all Viena Karelian words cannot be understood only based on Finnish, but studying Viena Karelian vocabulary and grammar is needed.

In order to solve the research problem, a design science research [24] together with qualitative research approach was adapted. Several design iterations and evaluations were performed before finalizing game prototypes for user

experience testing. Before the design phase, user information, needs and wished were collected via informal interviews and discussions with various people from events of Karelian communities and Viena Karelian courses (e.g. members of Karjalan Sivistysseura and Pohjois-Viena associations, Karelian native teachers, Karelian actives). Findings from this data gathering phase indicated that teachers have needs for simple vocabulary games. The user interface and functions of games should be developed in Viena Karelian. Also, it was important to have different games where players could learn about culture, habits, costumes, handicrafts, looms, riddles and dictums. A game where a player could build own Karelian house and go for hunting and fishing was wished as well. Likewise, games where users could hear stories were proposed. All these ideas and needs are very important. However, we selected the need of vocabulary game as a starting point. Therefore, we investigated available materials for the content creation, for instance, Viena Karelian study books were acquired and studied. Moreover, the online Dictionary of Karelian [25] was familiarized, and thus decided to study if we could utilize the database of dictionary for developing a vocabulary game. Next, we present the game prototypes, which were developed for learning and practicing Viena Karelian vocabulary.

#### IV. DEVELOPMENT OF THE ŠANAKOŠKI WORD GAME

The mobile Šanakoški word game was implemented with Android Studio [26] and programmed with Java. The word game technically contains two games, which are single player game and two-player game. However, the goals on these games are somewhat different. On single player game, the goal is to progress in levels and that game mode gets more difficult with each level. From user point of view, aim is to learn and practice Viena Karelian words. From gamification point of view, user's aim is to reach higher levels and get more points. Instead, the goal in the two-player game is to beat your opponent by figuring out more words and thus getting more points than the opponent in a certain time limit. From user experience point of view this two-player option enables co-experience relating to playing but also improving both learning skills. This game mode can be regarded as a possibility for co-learning and knowledge sharing.

The development of the these single and two-player games varied, because two-player game required additional tools. Therefore, the development process regarding these two game modes are explained separately in the next two sections. The existing online Dictionary of Karelian [25] was utilized in the development of the word games. The utilization and tailoring of the code are explained also in this chapter.

##### A. Single player game mode

The idea of making this word game came from the coder's childhood word games. The game that was played were two player game, so single player game is kind of a variant from that childhood game. The idea of the word game is not really unique whether the game mode is single player game or two-player game. There are lots of different word games which have similar game mechanics, but according to our knowledge there is not existing this kind of word game made in Viena Karelian

or in any other forms of Karelian. In reality, only a handful of games were found regarding Karelian language, so there were lots of options for game ideas.

Game rules for word game are simple. Player just needs to form as many words as possible from the given main word. Main word length varies from 8 to 11 letters depending on what level the player has reached in the game. Fig. 1 shows how one can form multiple words from the example word "Pinewood". In the Fig. 1 word "Pihlaja" (rowan in English) is the example of how forming words in Viena Karelian.

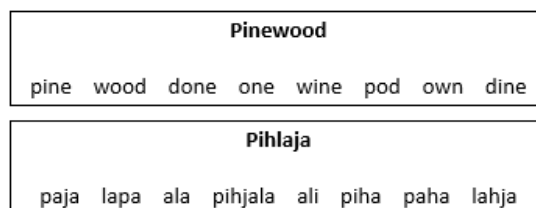


Fig. 1. Examples of how words are formed from the main word "Pinewood" (English) and "Pihlaja" (Viena Karelian).

Fig. 1 shows one example (pinewood) of how one can form words from main words. Two-letter words (e.g. 'ta' = and or 'ei' = no) are not accepted in this game, because they would be too easy to find. The longer the formed word is, the bigger the profit. For example, three-letter word brings one point and four-letter words award one additional point. In the Fig. 1 the example word "pinewood" has eight words, so the point total is  $2+2+2+1+2+1+1+2=13$  points and points gathered from "pihlaja" are  $2+2+1+7+1+2+2+2=19$ . To reach level 2 the player must get 5 points. Level progression and the way player receives points are shown in the next two lines of Java code.

```
private int[] RequiredPts=
{5,15,25,36,52,67,87,108,133,161,196,216,236,256,276,296,316,336,356,380,400,420,440,500};

private int[] pointChart=
{1,2,3,5,7,10,13,16,20}; //how many points
are awarded
```

The level cap in word game is the level 25 and to reach that level the player has to earn 500 points in total. Also, when the player forms longer than five-letter words he or she will get more than one additional point compared to a word that is one letter shorter. For example, if the player uses all the letters from the word "pihlaja" (e.g. pihjala) he or she will get more points. First number at the pointChart is from three letter word and the last is from 11-letter word. Getting twenty points requires the main word to be eleven letters long. Short words are quite easy to form, but when one tries to form longer than five letter words it will get harder. That is why additional points are awarded more when the player forms longer than five-letter words. Both the required points and awarded points are initialized in these two integer arrays. These values are not modified anywhere else in the source code, so if the game needs different level progression or point awarding changing these values would be enough.

A difficulty of the gameplay progressed very slowly in the game. It was important to us that test subjects could learn the

mechanics without a lot of stress. The game awarded 15 minutes time to advance the early levels and the main word stayed eleven letter length for the first two levels. The game did get more difficult when a player advanced up to level 10. The player only received 13 minutes to form words from 9-letter main word. On level 25, the player only received nine minutes and main word was only five letters long.

The word game uses the online Dictionary of Karelian [25] in its database. This database is used to confirm, if the word the player formed was Viena Karelian or not. The utilization and tailoring of this dictionary is explained later after the two-player game section. Fig. 2 shows the user interface (UI) of the word game from the level 3. The UI included buttons such as ‘Pyyhi’ (Delete), ‘Vaihda sana’ (Change word), ‘Kokeile’ (Try) and ‘Tyhjennä’ (Clear) (Fig. 2). Player has the option to change the main word up to three times in each level. When the user wants to check if the formed word is correct one, he or she push the ‘kokeile’ (try) button. The UI of this game version is in Finnish language. However, in the future development also Russian and Karelian languages should be taken into account in the game and UI development.



Fig. 2. The user interface of the Šanakoški word game at level 3

The UI in Fig. 2 shows differences between Finnish and Viena Karelian languages. The main word “Lyhytvarsi” translates to a short handle object. This word is similar to Finnish, but the word is not used like that in Finnish language. For example, the word “lyhty” which is being tried in the game is proper Finnish word which means “lantern”, but that word is not accepted because it is not used in Viena Karelian. Points are shown in the top left corner. Player still needs two more points to proceed to the next level. Game also has a time limit for reaching the next level. On the top right corner, the player can find the words he or she has formed from this particular given main word. Those three words ‘varsi’, ‘vati’ and ‘varis’ (handle, bowl, crow) are exactly the same in Finnish language too. It is important to notice that this fact that Finnish and Viena Karelian are very closed to each other, sets special characteristics for the design of serious games.

**B. Two-player game mode**

This game mode is called two-player game instead of multiplayer game, because multiplayer game could mean more than just two players. Instead, the word game is restricted to only two players at the time of writing this article. In the future, the multiplayer mode could be useful to develop, because then this game could be used together in Viena Karelian courses. Also, family members, friends and Viena Karelians learners could play this game together both on-site and online.

Two-player game mode follows the same rules as single player game but there are no levels or the option to change the word in the middle of game period. Before the game can begin two players have to be synchronized to the same game. This synchronization is done in the “waiting room”. When a player wants to compete in the word game, he/she chooses two-player game from the main menu. Then the player puts oneself to the waiting list, which then shows to another player that there is one player waiting. The one who is the quickest to accept the waiting player’s challenge gets to play against to the other player. This waiting room logic is provided by Firebases real time database [27]. Fig. 3 shows two stages in the waiting room. At first stage in Fig. 3a the game is not yet created, so the information text says that there are no players in the queue ‘Ei pelaajia jonossa’. Fig. 3b shows that player Juha has created a game and is waiting for an opponent. Now when some other player wants to play against Juha, he/she presses the ‘Liity’ button to join in the game. The logic of the waiting room (Fig. 3) is needed to succeed getting two players into the same game. After the other player joins Juha in the game, the ‘negotiation of the main word’ starts between players as shown in Fig. 4.



Fig. 3. The view of the UI a) when the user is in the waiting room before other players and b) after the game play is initiated



Fig. 4. Players’ Negotiation view before the actual game. Both players see the same view from their mobile phone and they can agree do they want to start to play from the proposed word like in the example ‘lyyhistyö’

Negotiation window has two buttons (Fig. 4). The left button ‘Vaihtoja 3’ informs the other player that he or she can change the word if does not want to take the suggested main word. The right button ‘Hyväksy’ shows that the player wants to keep the given and ‘accept’ the word. Both players have the option to change the word for three times. Also, the word change is dominant option, so the players must both choose to accept the

word or the options of changing the word ran out. Main word length varies from 8 to 11 letters in the two-player mode.

After the players have chosen the main word the real game begins. In our user experience tests we used two periods in this game mode and period time was 2 minutes. In the original childhood game, there was only one period of 15-20 minutes to decide which player has the better vocabulary. For testing purposes two periods and a short period time suited well. The user interface of the two-player game is quite similar to single player UI. The option of changing the word when the game has started is absent and both players can also see opponents points almost in real time. We thought that in the spirit of competition it is important to know in real time how your opponent is performing in the game.

### C. Tailoring the online Dictionary of Karelian

In order to develop the Šanakoški game prototype for learning Viena Karelian, the game needed comprehensive Viena Karelian word database. This database was provided by the Institute for the Languages of Finland (Kotimaisten Kielten Keskus, abbreviated as Kotus). Kotus has an online Dictionary of Karelian [25], which is a dialect dictionary of Karelian. It describes the vocabulary of the two main dialects of Karelian: Karelian Proper and Olonets Karelian (Livvi-Karelian). The dictionary has been published both in print and online (Fig. 5) and it is available online [29].

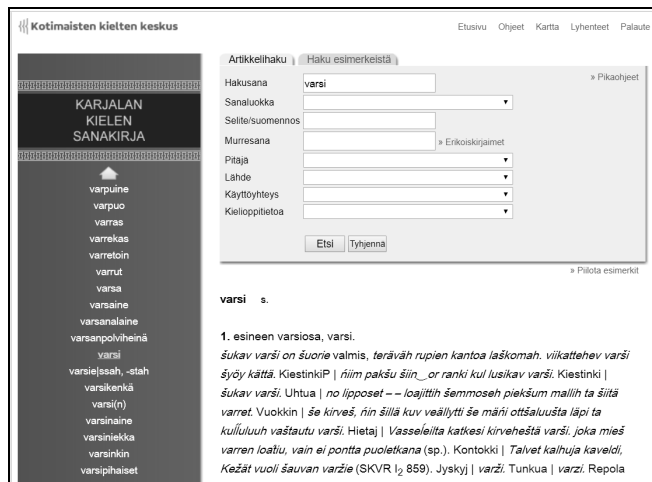


Fig. 5. Screen capture of the online Dictionary of Karelian. Findings for the example word ‘varsu’ shows first translations how the word was used in Viena Karelian cultural areas where they have been collected for the dictionary such as Kiestinki, Uhtua, Vuokkiniemi, Hietajärvi, Kontokki and Jyskyjärvi.

Dictionary is licensed with Creative Commons Attribution 4.0 International Public License [30]. Dictionary can be used in the browsers or it can be downloaded in multiple xml-files. Xml-files can be parsed to pick the relevant data from the files. In our project, the focus was to pick Viena Karelian words from the dictionary. These multiple xml-files contain over 88000 Karelian words and about 19200 of these words are Viena Karelian. These 19200 words with about 600 additional words from two Viena Karelian study books [31][32]. Next code segment shows an example of one dictionary entry in one xml-file.

```
<DictionaryEntry sortKey="82310"
identifier="varsu"><HeadwordCtn><Headword>varsu
i</Headword><SearchForm>varsu</SearchForm><PartOfSpeechCtn><PartOfSpeech display="no"
freeValue="s."
value="noun"/></PartOfSpeechCtn><GrammaticalNote display="yes">s<Definition>esineen
varsiosa,
varsu.</Definition><ExampleBlock><ExampleCtn><
Example><Fragment>šukav varsu on
šuoie</Fragment> valmis, <Fragment>teräväh
rupien kantoa laškomah. viikattehev varsu šyöy
kättä.</Fragment> </Example><FreeTopic
type="levikki">
<GeographicalUsage freeType="pitäjä"
class="pitäjä">KiestinkiP</GeographicalUsage>
```

Xml-files were full of various information regarding every Karelian word. Dictionary entry tags were the outer tags for every word. The word ‘varsu’ is the entry number 82310 in the dictionary. For some words there were also definition tags which contained the definition of the word as can be seen from the example code. Unfortunately, these tags were often empty tags. Geographical usage tags were very important because those tags showed where the word is used. The word ‘varsu’ for example is used in Kiestinki.

Technique that was used to parse the xml-files in order to get the right information from the files is shown in the next four code segments. First the xml-parser has to be set up in the Java code. The code used to set up parser was just slightly altered compared to the code snippet which were shown in the Android Studio documentation page [26]. After the parser was connected to the xml-file in question, we needed to write a code, which enables to get the relevant data from the file. Next, every code segment is explained in detail.

```
processParsingParser(XmlPullParser parser)
throws IOException, XmlPullParserException {

int event = parser.getEventType();
String name = parser.getName();
while (loop) {
switch (event) {
case XmlPullParser.START_TAG:
//this case-structure is shown in the
next code segment

case XmlPullParser.END_TAG:
//this case-structure is shown last
} //switch
event = parser.next();
} //end of loop
```

Method contains one switch-structure, which checks if the tag is open or closing. Name variable saves the name of the tag. Switch is in a loop and the loop repeats itself as long as there are tags in the file. The opening tags case structure is shown next.

```
if (name.equals("Headword")) {
String tempWord = parser.nextText();
}
else if (name.equals("GeographicalUsage")) {
```

```
String
usage=parser.getAttributeValue(null,"fre
eType");
if(usage.equals("pitäjä") && !dialect) {
    tempPlace = parser.nextText();
    if(tempPlace.equals("Uhtua")||tempPlace.
equals("Jyskyj")||
tempPlace.equals("Kiestinki")||tempPlace
.equals("Pistoj")
||tempPlace.equals("KiestinkiP")||tempPl
ace.equals("Vuokkin"))
    dialect = true;
```

HeadWord tag contains the word. Word found in Headword tag is then temporarily saved into a tempWord variable. Then the code checks where that word is used. All those places in the code like Uhtua, Kiestinki, etc. belong to Viena Karelia. If the word is used in some of those places, then the code sets dialect as true. Next code segment shows the case structure for closing tags.

```
if (name.equals("Dictionary"))
    loop = false;
}
else if (name.equals("DictionaryEntry")) {
    if (dialect) {
        dictionary.add(tempWord);
        dialect = false;
    }
}
} //end of loop
saveData();
} // end of method
```

First the code checks, if this is the final closing tag of the whole dictionary file. If the closing tag is just for the dictionary entry, then if the dialect was set true the code adds the tempWord to an Arraylist named dictionary. After that the dialect variable is set back to false and the whole loop is executed again. If the closing tag was the last closing tag, then the loop ends. Code execution then moves to saveData() method and in that method the dictionary Arraylist is saved in its entirety to the memory of the Android device. This whole parsing process is only done when the code is executed for the first time in any given Android device.

Even though the xml-file parsing looks straight forward in here, the process proved to be very laborious. There were lots of problems regarding the xml-files. The structure of the tags in those files threw multiple errors in Java code and that is why xml-files needed constant manual editing. This editing was done with the tool Notepad++. Also, there were as much as hundred xml-files containing dictionary entries, so we decided to connect those hundred files to a one huge file. This in turn brought more problems because the file that contained the whole dictionary had 1.2 million lines of dictionary entries and because of the size of that file it became very slow to process. Manual editing was also very laborious but eventually the word game received all the 19 200 Viena Karelian words and the additional 600 words from the books.

V. DEVELOPMENT OF THE HIRSIPIUU GAME

Similarly, as Šanakoški Hirsipuu game was also developed with Android Studio [26] and programming language Java. In general, a concept of hangman game is very familiar for the

general public, for instance, many people have played it with a friend or family member by using a pen and paper interaction. Also, mobile hangman game applications exist. However, according to our knowledge, there is not any version of this type of game in Viena Karelian. Therefore, we regarded as important to develop hangman game with a vocabulary of Viena Karelian. For this game, we collected words manually from online Dictionary of Karelian [25] and the text books by Olga Karlova [31] and Jevgeni Karakin [32].

A. Basic, Theme and Letter Hint game modes

Our Hirsipuu game is not quite the same as the traditional hangman game. This game has three game modes. Game modes are Basic Game, Theme Game, and Letter Hint Game. Basic Game started with four-letter words. When player guessed the word correctly, he or she would progress to the next level. Table 1 shows the progression in the Basic Game mode.

TABLE I. PROGRESSION IN THE BASIC GAME MODE

Hirsipuu (Basic Game Mode)		
Level	Word Length	Time (min)
1	4	5
2	5	5
3	6	5
4	7	5
5	8	5
6	9	5
7	10	5
8	11	5
9	12	5
10	13	5
11	14	5
12	4	4
13	5	4

When the player reaches level 12, the word length drops back to four but this time the player only has four minutes instead of five. Next cycle will also drop one minute from the time. When player only has two minutes per level then the game just takes 30 seconds from the previous cycle time and so on. Player also receives points from the game. Next formula shows how the points are awarded in the game: Points = (Points + level\*100) +time/1000. For example, if the player has exactly one-minute left on the game clock when he or she reaches level four and the player has 700 points from earlier levels, then the points when level four starts are: (700+3\*100) +60000ms/1000=1060 points. The reason why the game progresses like this, is the lack of longer words in this game version. Of course, there are 15 letter words and even longer in Viena Karelian, but the amount of words diminishes the longer the word gets. This would mean that the player would get same long words too frequently and that is not good for the game. That is why we decided to go back to four letter words when the word length goes longer than 14. The gameplay still gets more challenging because time diminishes.

The Letter Hint Game mode progresses the same way as basic game, but every word has one letter shown. It is completely random, which letter of the given word is shown. If the hint letter is for example ‘K’ then every ‘K’ is shown

from the word. This game is easier than Basic Game, so the mode suits better for beginners.

Third game mode called Theme Game does not have a game clock. First the player chooses the theme from which he/she wants to practice. At the time of the UX tests there were six themes to choose from. Themes were seasons and numbers, verbs, animals, nature, relatives and body parts. This game mode helps players to learn particular types of words. Word length is also completely random on every level because different themes just do not contain enough words to make the gameplay similar compared to Basic Game. Some themes only had about 30 words, so it would not be reasonable to choose particular length words. Also, because there was not a game clock, player points were calculated differently:  $Points = (Points + level * 100) + remaining\ guesses$ . This game mode awards more points, the less a player uses his/her guesses. It is important to point out that the player will not lose his/her guesses when the suggested letter is in the word. The Fig. 6 depicts the UI of the Hirsipuu game a) Basic Game and b) Theme Game, where the selected theme in this case was "Seasons and numbers" (Vuodenajat ja numerot).

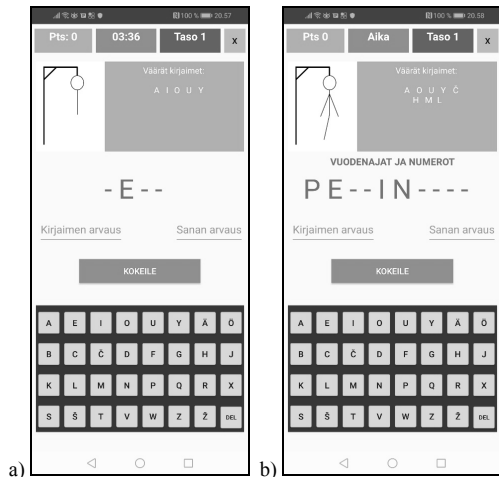


Fig. 6. The UI of the a) Basic Game and b) Theme Game

Basic rules for the Hirsipuu game are valid in all three game modes. The player has nine guesses before he/she gets hanged. The player can suggest only one letter at a time but in this particular game the player can also suggest the whole word. The option to suggest the whole word will be very vital when the player gets low on time. In the game, the letter suggestion field 'Kirjaimen arvaus' is active by default, so if the player wants to suggest the whole word, he/she has to touch the word suggestion field first 'Sanan arvaus'. Button 'Kokeile' (Try) will check if the letter is in the word. If the word does not have the suggested letter, then the player is one step further becoming hanged and the suggested letter will go to the wrong area 'Väärät kirjaimet' and a notification of the wrong selection will appear on the screen for a moment.

*B. Top lists in the Šanakoški and Hirsipuu game prototypes*

The both games used Firebase real time database to maintain high score lists. Lists contain ten best results in every game mode. Players had the option of typing their initials

before the game, so they would be able to see themselves at the high score list. We thought that it would be important for people to see their initials in the high score list when they do well in the game. In the tests, participants used our mobile phones when played these games, and thus were able to see how they succeed in the list competing to other participants. Fig. 7 shows Theme Game Top-3 scores in the real time database and the code segment after shows how the data is uploaded to that real time database.

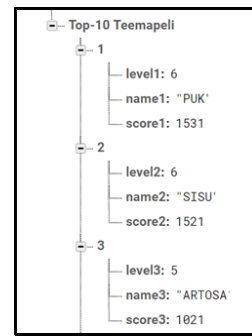


Fig. 7. The Top-3 scores from the Theme Game Mode

```
top10ThemeRef.child("1").child("name1")
    .setValue(name);

top10ThemeRef.child("1").child("score1")
    .setValue(score);

top10ThemeRef.child("1").child("level1")
    .setValue(level);
```

In the code "top10ThemeRef" references to the Theme Game TOP-10 list. First child then references to the position of the list. This code references to the first place. Now that the reference is in the right position, then the name of the player with his or her score and game level can be uploaded to positions name1, score1 and level1. SetValue method is used to make the change in the database.

VI. USER EXPERIENCE EVALUATION

In this chapter, we first present the test settings and participants. Then user experience findings relating to the both games and other concepts are described.

*A. Test settings and Participants*

We conducted user experience evaluation with the 16 participants, whose age varied from 10 to 84 years old while average was 53 years. Nine of the users were female. Half of the participants had studied Viena Karelian in courses. 13 percentage of users regarded them-selves as 'native' speakers because they have learned Viena Karelian from their parents or grandparents. According to users' own estimation 50% of participants were able to read well, 44% speak well and 38% write well Viena Karelian. In total, 63% of users had more or less prior skills of Viena Karelian.

According to the time constrains we conducted four evaluations as pair testing (Fig. 8) and the eight test as individual testing. However, the test procedure was similar in each test, except in the first four test we did not have time to

ask participants to create (by drawing or writing) their own game design, therefore these results are not presented in this paper (Fig. 9, task 9). In the pair evaluation, participants played two-player game mode against each other and in individual evaluations participants played against the moderator.

We tested Šanakoški and Hirsipuu game prototypes as a part of a larger user experience evaluation (Fig. 9), because we wanted to collect users' ideas and feedback also to other game concepts in order to get a comprehensive understanding of the possible future serious games for learning Viena Karelian. All tests were video recorded and duration of tests were 14 hours and 56 minutes in total. Before the tests, participants filled a consent form and a short pre-questionnaire about the language background and prior game experiences.



Fig. 8. In pair evaluation participants used together the game prototypes.

1. Introduction, consent form, pre-questionnaire
2. Use of the Šanakoški word game prototype (single player game)
  - Adjective selections + arguments 3/26
3. Use of the Šanakoški word game prototype (two-player game)
  - Pros & cons of single and 2-player modes
4. Discussion of the concept: Vocabulary creation application
5. Use of the Hirsipuu hangman game prototype
  - Adjective selections + arguments 3/26
6. Discussion of the Learn Viena Karelian game + example questions
7. Discussion of the concept: 3D virtual Kizhi Island + Karelian village
8. A short summary of the concepts and final questions
9. Draw or write your own game idea for learning Viena Karelian\*
10. Rewarding and closing

Fig. 9. User experience evaluation procedure included 10 phases. The task nine is not discussed in this paper.

We collected user experiences by adapting the adjective method [34] and interviewing and observing. We created the set of 26 words and wrote them on A4 paper. After the use of Šanakoški and Hirsipuu game prototypes, we asked participants to select three out of 26 adjectives, which depict their experience relating to game play or how they perceived the game. After that participants commented their selections and experiences. (Fig. 9)

*B. User experiences of the Šanakoški game prototype*

Participants' experiences relating to word game were mainly positive (Fig. 10). Half of the users regarded that game support learning. One test user (ID 12) thought that this game

could be suitable for primary school pupils. Other participants (ID 8) selected adjective Useful and commented that this kind of mobile game is good for all who are interested in learning certain language, because from mobile phone it is easily accessible. Three persons selected adjective Businesslike and they gave arguments such as: "words has a real meaning in language" (ID 10). By this the person regarded that the game included a wide and versatile vocabulary. Other user (ID1) who selected Businesslike, commented that the game does not feel like a toy. The third person (ID15) selected Businesslike because the game has a good playability. However, this person thought that there is not a "hook" in the game.

Results indicates that the Šanakoški word game was experienced to be more serious game than pure entertaining game with fun or playful aspects. 25 percentage of participants experienced word game prototype as entertaining, but 19 percentage as boring. Even though participants regarded game as Easy to use (63%), the usability of the UI could be improved along with the visual design. In the current version, the visual style of the game was quite neutral and minimalistic. In the future design it would be good to have graphical designer in the team. This could help to provide better user experience from the aesthetic pleasure point of view. Also visual design style could indicate somehow that the game relate to Viena Karelian (e.g. by using symbolic colors or ornaments).

The main critical issue in this type of word game is the trustworthiness of database. For instance, when the users tried to add words such as varši, šie, kakši, but the game did not accept those, it started to irritate especially participants who knows Viena Karelian vocabulary. The search form of current online dictionary requires to use words with normal s (e.g. varsi, sie, kaksi) and then as search results in the example sentences those words are written with š letter. This SearchForm was used in the word game developed as described in Chapter IV. This problem indicates that for game design we should develop a new database which accept words correctly as they are taught in the study books.

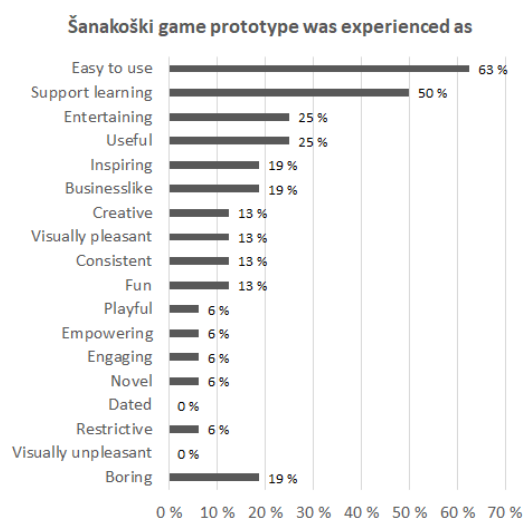


Fig. 10. Users' adjective selections for the Šanakoški word game prototype.



### C. User experiences of two-player game mode in word game

We wanted to know which game mode participants would prefer and thus we asked users to select which one they like more, 1-player or two-player game mode. Because our test sample is relatively small, only 16 participants and their age varied from 10 to 84 years, we cannot present universal answer to this question. However, we notice that older users preferred more the single player mode because they appreciated more unrestful test situation with proper play time. They thought that play experience is then better. Instead, those who preferred two-player mode regarded that competition brings more excitement into game situation and that was perceived as an important factor. This brings more gamification to this serious game. From all users, 56 percentage preferred two-player mode and 31 percentage single player mode. The rest did not give opinion for the question or were not able to select.

When participants started to play together they were quite quiet, because they needed to focus on figuring out the words. They heavily concentrated on words, so they did not notice very well the play time or how much play mate has got points. Maybe the UI could be improved by visual design so that the time left could be indicated more distinctive way. One participants (ID 10) commented that in two-player game there should be around 15-20 minutes for each play round / word. In our limited test situation this was impossible to take into account. This person commented also that the game should check the correctness of words after the play round, because now it was possible to try out all letter combinations without really thinking or knowing the correct Viena Karelian words. This related to fact that some words are similar in Viena Karelian and Finnish, which means that player can just try different Finnish words without skills of Viena Karelian. This is special aspect which need to be taken into account when developing serious games for learning Viena Karelian from Finns point of view. With Viena Karelians, whose official language is Russian, the situation may be different, because some words are close to Russian language as well.

One person (ID10) commented that the game could work better in portrait orientation. This person was left-handed which may have had some influences on user experiences. Even though the UI of the game was quite centered and left space to hold the device as a user wants. However, in the future development it is important to take this issue into account and check the best usability for both, left and right-handed persons.

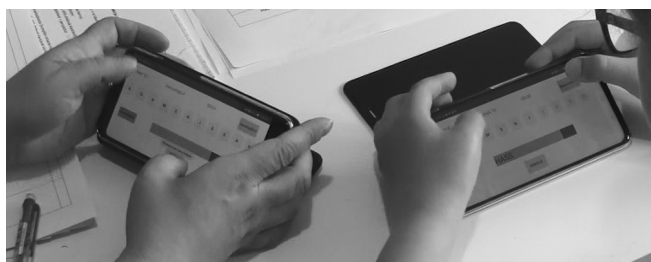


Fig. 11. A two-player game situation when playing the Šanakoški prototype

### D. Concept of vocabulary creation application

The idea of this concept (Fig. 12) was to provide a mobile or web tool for users (e.g. teachers, Karelian actives) to add words to the game or dictionary database. For instance, currently quite many words cannot be found from the online Dictionary of Karelian [25], because it is relatively old collection. From Finns and new learner's point of view, modern words relating to everyday life can be found mainly from the new books such as Karlova [31], Zaikov [33] and Karakin [32] or new papers, for instance, Oma Mua [35]. Also one option is to go the course, but this is location-dependent way to study, and thus maybe not possible for all.

The basic idea in this application is that a user can write the word (e.g. Äkkiouto) and then possible Finnish translation, meaning and source where the word is found (Fig. 12a). Also it would possible to add words that the person has learned for instance from grandparents or other descendant of Viena Karelians. The user could add information in which town or village it is used and who has said or collected this word (Fig. 12b). In the test, this concept was introduced to the participants by a simple low-fidelity prototype visualization.



Fig. 12 Example use cases in the concept of the vocabulary creation application. A) A user has found a word Äkkiouto from the book Kalevala vienankarjalakši and added it into a database without translation. B) A user has added word "Viheliäine" into database with translation and source information. Idea is that tther users could supplement the information.

In this concept, the collection of vocabulary and checking could be done following the idea of crowdsourcing, where users add content and check content. When the added word achieves the common acceptance from the Karelian community in certain period of time, it could be accepted into database. Other option could be that a group of Viena Karelian teachers and natives takes a responsibility of administration of the acceptance of database content. During this concept presentation test users commented that there exist variations of words between different villages. Also, some words can have been changed among descendants of Viena Karelians, who have lived in Finland during their whole lives. For instance, the example word 'Viheliäine' (Fig. 12b) would be in Viena Karelian as 'Viheliäini' as users commented. Words which ends as -ne or -nen are Finnish forms of words. The one idea in this concept is a possibility to collect these kinds of variations as well.

This concept was perceived as useful among participants. Especially participants who had Viena Karelian knowledge

and background commented that it is significant to collect old word that they will not disappear at the same time when new words will be taken to use. Two persons (ID6, ID7) commented that this type of word collection application would be useful for linguists, but they-selves would be also interested in using it. One person regarded that this application could help to revitalize old language and this could help young people in language learning. In general, 86 percentage of participants perceived this concept as positive way. They commented that a strong checking should be implemented in order to avoid accepting to add wrong words. Trustworthy is a critical factor in this type of application. This indicates that two aspects are needed for the application: word collection and word acceptance.

*E. User experiences of the Hirsipuu game prototype*

Participants user experiences relating to Hirsipuu game were mainly positive (Fig. 13) as it was perceived as Easy to use (38%), Inspiring (44%), Entertaining (31%), Fun (31%) and Useful (31%). Also, it was regarded as supporting learning (25%). One person who selected adjective Support learning, commented that this type of game is suitable for training and recapping words that have been learnt in the lecture for instance. This means also that player would need some basic knowledge of Viena Karelian before really start to play this game. For instance, Viena Karelian word ‘Liipukkaini’ is in Finnish ‘Perhonen’ (Butterfly), and this kind of word is impossible to figure out only based on Finnish without any studies of Viena Karelian. The Fig. 14 shows an example where the participants has selected theme ‘nature’ and randomly appeared word seems to be too difficult, because two guesses are left.

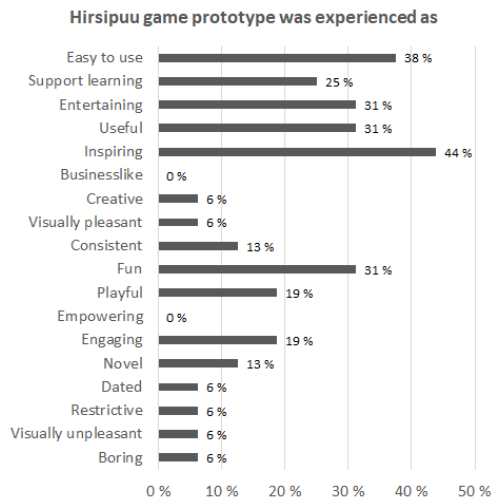


Fig. 13. Users’ adjective selections for the Hirsipuu game prototype.

Results of the Hirsipuu indicated that this type of game is good for people who like to play crosswords. Some participants had a feeling that this game would suite better for adults than young people. One person, from the age group 36-45 selected adjective Dated, but this adjective was not regarded as a negative issue. Instead, the person commented that the hangman idea is old, but it is still good. Instead, one

senior user from age group 76-84 compared this hangman game metaphor to real life hangman situation during the Second World War when people had to escape and leave their home towns in Viena Karelian. This comment reminds us how important mother tongue is for humans and how big part it is of our identity and life experience. When developing games for revitalizing Viena Karelian dialect and culture we should know the history very well and careful make design solutions by taking into account many aspects relating to Viena Karelian’s rich cultural historical background including for instance, poem singers, bag merchants, handcrafts and poor circumstances over a period of times. This is an important aspect when designing serious games for revitalizing endangered languages.

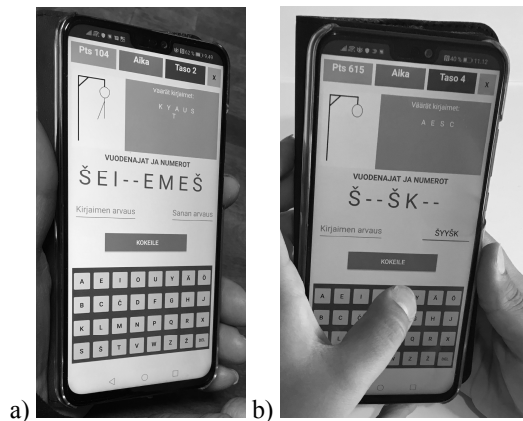


Fig. 14. The Hirsipuu game in the Theme mode ‘Vuodenajat ja numerot’ (seasons and numbers), where a) the participant needs to figure out that letter č is required in order to reach the next level. The other user b) tries to guess the whole word and is writing ‘šyyskuu’.

*F. Learn Viena Karelian web game prototype*

This game prototype tries to revitalize Viena Karelian dialect and culture by providing to players a possibility to practice reading, listening and writing skills in different levels of difficulty [17]. This game is targeted for beginners and it starts with simple word and sentence examples and the level of difficulty increase the more the player complete the levels. The current version of this prototype (Fig. 15) includes seven topics: food and drinks, clothes, furniture, seasons, body parts, numbers, and week days and months. The game prototype can be used in desktop, touch phone and tablet context. The UI looks the most optimal from tablet device, because this was the target device when developing the prototype.

Nine of the 16 participants played this Learn Viena Karelian game and for the rest of the users the game was introduced from the paper with example images and questions. This was because of time constrains during the one testing day. However, answers to the same questions were collected from all users. In this game, the player was able to earn points, which was perceived as positive feature by almost all participants. Two persons (ID 3, ID14) commented that points are not important for them, but they can be for other people. One person (ID15) said that points are not necessary in this kind of learning tool. Generally, participants (88%) were not interested in sharing own results (e.g. points) in social media

applications and one young user commented that this type of sharing is “fleksausta” (boasting). In the game, the progress of passing the levels was showed as ‘stars’ and this was mainly experienced positively (Fig 15). However, one person (ID9) regarded this visualization as “hotels’ star classification”.

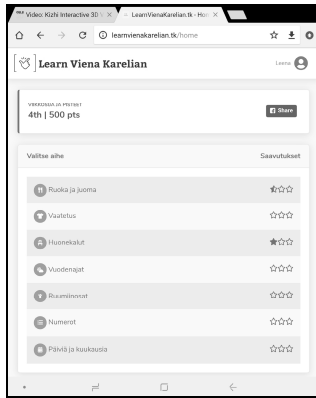


Fig. 15. The home page of the Learn Viena Karelian game prototype

One function in the game was to provide cultural information when the player passes different levels. This cultural information was implemented as images and texts. Participants did not really like that this information appeared after the level was completed. Instead, they perceived them as disturbing the game flow and this was more perceived as advertisement. The study indicated that this type of cultural teaching should be implemented differently, for instance, the game could include “a cultural bank” where all achieved information is collected and player could visit there when ever wants, not during the gameplay when practicing words.

G. Karelian village concept (3D Kizhi Island as a reference)

We showed to our test participants the video of the 3D virtual Kizhi Island [28] and also a set of images of the Kizhi outdoor museum (Fig. 16). Our aim was to illustrate if there could be a game with generic Karelian village, where a player could build own Karelian house and experience Karelians lived in early days, but also how they are living nowadays. This kind of 3D virtual game could include several minigames to learn language and culture. This type of game could interest young players if the game is motivating and engaging and the quality of the visual design is high enough.



Fig. 16. The concept of generic Karelian village game was introduced to the participants by showing a video of 3D Kizhi virtual Island or a set of examples images from a) outside and b) inside contexts c) in summer and d) winter seasons.

Participants suggested that in this type of game, it would be useful to have different mini games such as memory games relating to cultural aspects (e.g. architecture, objects of church, Karelian items). One person (ID 11) suggested that this type of Karelian village game could include mini games relating to Karelian traditional ways of hunting, fishing and farming.

H. Themes for Karelian games

During the development of these concepts and prototypes we have tried to collect the suitable set of themes to practice Viena Karelian. The table II shows the themes we provided and what participants suggested or were interested in. These topics (Table II) show that there are plenty of issues which should be included in games in order to teach Viena Karelian and culture. Of course, these topics can be covered during the courses by teachers. However, in order to revitalize language, we should provide effective tools for location-independent self-learning as well. Serious games could be one solution for that. Moreover, it would be important that teachers could utilize serious games during the courses.

TABLE II. TOPICS WHAT WE PROVIDED AND PARTICIPANTS SUGGESTED

Topics provided in concepts and prototypes	Topics suggested by participants
1. alphabet, 2. numbers	1. living, 2. living culture, 3. vehicles
3. family members, 4. relatives	4. fishing, 5. hunting, 6. farming
5. food, 6. drinks	7. history, 8. literature, 9. music
7. week days, 8. months	10. occupations, 11. characters
9. seasons, 10. weather	12. appearance, 13. personality
11. clothes, 12. furniture	14. communication
13. animals, 14. nature	15. domestic animals, 16. plants
15. colors, 16. body parts	17. habits, 18. feasts
17. history, 18. culture,	19. weddings, 20. funeral
19. architecture, 20. buildings	21. sports, 22. hobbies,
21. rune songs, 22. rune singers	23. outdoor toy, 24. games
23. information of Viena Karelian villages	25. handicrafts, 26. knitting, 27. birchbark works
	28. electronics, 29. geometrics, 30. chemical elements
	31. health, 32. illnesses, 33. Karelian wise man, healer

VII. DISCUSSION

In this paper, we introduced concepts and prototypes for learning and teaching Viena Karelian vocabulary and culture from Finnish users points of views. Also, we presented the findings from UX evaluation conducted with 16 participants. In the future, more user studies should be conducted together with Viena Karelian teachers and actives both in Finland and Republic of Karelia with different user groups (small children, teenagers, adults, seniors) with various language skills backgrounds. Also, it would be useful to conduct long-term evaluation with two-player games in order to support and study communication between Finns and Viena Karelians.

Our study supports the prior research about a need of revitalizing the endangered language [8][17]. One approach is to see players in a big role for revitalizing Karelian language by playing games and using gamification applications that

support learning Karelian language and culture in both countries, in Finland and Russian.

### VIII. CONCLUSION

In this paper, we present gamification concepts and game prototypes (Šanakoški and Hirsipuu) developed for learning Karelian language and especially Viena Karelian, which is the closest dialect to Finnish language. We conducted UX evaluations with 16 participants whose age varied from 10 to 84 years. 63% of users had prior skills of Viena Karelian. The users experienced the games mainly positively. The Šanakoški prototype was regarded as Easy to use, Support learning, Useful and Entertaining. Hirsipuu prototype was perceived as Inspiring, Easy to use, Entertaining, Useful and Fun. The participants were interested in concepts of creating vocabulary and having generic Karelian village game. Especially they proposed many different topics which should be considered in games in order to teach old language and culture, but also everyday life issues. Even though we got positive experiences relating to these games and concepts, in the future designs, much more emphasis should put on developing mobile and web games for different age groups with various language skills backgrounds. Thus, more game development projects are needed with larger teams including Viena Karelian teachers and actives. It would be important to develop serious games for Viena Karelian teachers' purposes as well. Moreover, the study indicated that a modern digital dictionary of Karelian language is needed for the general public.

### ACKNOWLEDGMENT

We would like to thank the Karjalan Sivistysseura ry for the student grant for the VIENA-PELI project. We warmly thank our test participants, and especially Anja Suvanto and Kerttu Nurmela from the association of North-Viena for enabling our tests during the club of Viena Karelian and culture. We also thank University of Oulu, CraftMasters program for funding the Šanakoški project and INTERACT Research Unit for the internship grant.

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